# *Heteromysis zeylanica* Tattersall (Crustacea : Mysidacea), an associate of Madreporarian Corals in South Indian Waters

BY

N. KRISHNA PILLAI

*Marine Biological Laboratory, University of Kerala, Trivandrum-7*

(*With twenty-six text-figures*)

Mysids are predominantly free living marine animals more abundant in comparatively shallow water. No species has so far been recorded as a parasite. However, as early as 1879, Hilgendorf recorded *Heteromysis harpax* as an associate of hermit crabs inhabiting gastropod shells. Nothing was known about the nature of this association until Clarke (1955) published very interesting observations on the association between *H. actineae* and the sea-anemone *Bartholomea annulata*. Since then O. S. Tattersall (1962) reported *H. harpax* as an associate of hermit crabs of the genus *Dardanus*, *H. gymnura* from the arms of an ophiuroid and *H. zeylanica* from a sponge.

While washing corals for collecting their copepod associates my colleague Sri M. J. Sebastian obtained a number of specimens of *H. zeylanica* W. M. Tattersall (1922). This probably indicates that a majority of the species of *Heteromysis* live in association with invertebrates. I, therefore, give below a short résumé of the available information on the genus *Heteromysis* as it may help those who take up the study of the ecology of these mysids. A detailed study of the specimens collected has shown that a few interesting features in the morphology of *H. zeylanica* have so far escaped notice, therefore the species is redescribed.

## HISTORY OF THE GENUS *Heteromysis*

The genus *Heteromysis* was created by S. I. Smith (1873) to describe *H. formosa* collected from the coastal waters of North America. Subsequently this species was recorded from several localities in European waters. G. O. Sars (1877) created the genus *Chiromysis* to describe

*C. microps* collected from the coastal waters of Africa. To the latter genus Hilgendorf (1879) added a second species *C. harpax*. Later on G. O. Sars (1885) described *H. bermudensis* collected from Bermuda and also admitted that his *Chiromysis* is a synonym of *Heteromysis*. Walker (1898) described *H. odontops* from North American waters and Holmes (1900) added another species, *H. spinosus*. The latter was, however, found to be synonymous with *H. odontops* Walker. Bonnier & Perez (1902) created the genus *Gnathomysis* to describe *G. gerlachei* collected from the Red Sea. They published a short description without figures. W. M. Tattersall (1922) examined the unpublished illustrations made by Bonnier and concluded that *G. gerlachei* is a synonym of *H. harpax* and that *Gnathomysis* Bonnier & Perez is the same as *Heteromysis* S. I. Smith.

The discovery of more species followed in quick succession. From the Gulf of Mannar, south India, W. M. Tattersall (1922) described *H. proxima*, *H. zeylanica* and *H. gymnura*. Verrill (1922) described *H. antillensis* from Dominica but this was later found to be a synonym of *H. bermudensis* G. O. Sars. While describing a collection of mysids from Australia W. M. Tattersall (1927b) added *H. waitei* and *H. tasmanica* and a third species *H. digitata* (W. M. Tattersall 1927a) from the Suez Canal. From subterranean salt water pools at Canary Islands, Calman (1932) described *H. cotti*. More recently Nouvel (1940) described *H. armoricana* and *H. tattersalli* (Nouvel 1942) from France and Cape Verde Islands respectively. From the Mediterranean Bacesco (1941) recorded *H. eideri* and Pillai (1961) described *H. macropsis* from south Indian waters. Clarke (1955) added a very interesting species *H. actineae* from Bahama Islands and O. S. Tattersall (1961) described *H. atlantidea* collected from African waters. Lastly Ii (1964) described *H. xanthops* from Japanese waters.

Recently Nouvel (1964) examined the original illustrations of *H. gerlachei* prepared by Bonnier and concluded, contrary to the opinion of W. M. Tattersall, that *H. harpax* Hilgendorf and *H. gerlachei* Bonnier & Perez are separate species and that *H. harpax* Kossmann (1880) is different from both. He renamed the latter as *H. kossmanni*. The genus *Heteromysis* thus includes twenty-one species.

*H. formosa* S. I. Smith, 1873
*H. microps* (G. O. Sars), 1877
*H. harpax* (Hilgendorf), 1879
*H. bermudensis* G. O. Sars, 1885
*H. odontops* Walker, 1898
*H. gerlachei* (Bonnier & Perez), 1902
*H. proxima* W. M. Tattersall, 1922
*H. zeylanica* W. M. Tattersall, 1922
*H. gymnura* W. M. Tattersall, 1922

*H. waitei* W. M. Tattersall, 1927
*H. tasmanica* W. M. Tattersall, 1927
*H. digitata* W. M. Tattersall, 1927
*H. cotti* Calman, 1932
*H. armoricana* Nouvel, 1940
*H. eideri* Bacesco, 1941
*H. tattersalli* Nouvel, 1942
*H. actineae* Clarke, 1955
*H. macropsis* Pillai, 1961
*H. atlantidea* O. S. Tattersall, 1961
*H. xanthops* Ii, 1964
*H. kossmanni* Nouvel, 1964

## Ecology of *Heteromysis* spp.

A surprising fact about species of *Heteromysis* is their comparative rarity. Most of the species have till recently been described only from a few specimens accidentally obtained during the course of routine collecting.

As early as 1879 it was known that *H. harpax* lives in association with hermit crabs inside gastropod shells. But that this association is obligatory at least for the mysid has been proved only very recently. Since Clarke (1955) published his observations on *H. actineae* evidence was obtained showing that at least two other species live in association with hermit crabs, one species with ophiuroids and one with sponges and corals. As observed by O. S. Tattersall (1962) ' it is now beginning to be apparent that the paucity of material may be due not to the rarity of the different species so much as to their cryptic mode of life'.

The available information on the ecology of the species has been summarised by Clarke (1955) and O. S. Tattersall (1962). According to Clarke *H. formosa* generally lives in small colonies within the empty shells of large bivalves and gastropods. This shows their natural tendency to seek suitable shelters.

Clarke observed *H. actineae* living in small colonies among the tentacles of the sea-anemone *Bartholomea annulata.* He made detailed observations both in the field and in the laboratory. The mysids spent most of their time coursing up and down the length of the tentacles of the anemone or spiralling around the base of the tentacles and never strayed away from the anemone. Clarke reported that the anemone was quite indifferent to the presence or absence of the mysids. Whenever food was given to the anemone the mysids were never found to take it. On the other hand every particle rejected by the anemone was at once seized and eaten. Clearly there is perfect understanding between the partners and this is a clear case of commensalism.

O. S. Tattersall (1962) reported the collection of *H. harpax* from various species of pagurid crabs of the genus *Dardanus*. She observed that this 'is a true commensal with the hermit crabs, receiving protection from them and feeding upon their faeces, thereby keeping the innermost region of the shells they inhabit clean and free from waste matter.' O. S. Tattersall also reported the collection of *H. gymnura* from among the arms of a large brittle star, *Astroboa nigra* Doderlin.

*H. zeylanica* was first discovered as free living among the littoral sea weeds in the Gulf of Mannar. Later it was collected from the central cavity of a tubular sponge from African waters. During the present investigation it was found associated with two species of corals, *Favia* sp. and *Montipora* sp., being much more abundant on the latter. As I had no chance to study them alive nothing can be definitely stated about the nature of the association. However, the following conjecture may be made. Mysids generally feed by filtering fine particles of food from the water or eat large morsels by holding them with their legs. The massive third thoracic endopods indicate that *Heteromysis* belongs to the latter category. Coral polyps are very much like anemones in their method of feeding. Those with large tentacles are true predatory carnivores but others with small tentacles entangle the food in mucus and get them wafted towards the mouth by ciliary current. According to Hyman (1940) plankton constitutes their main item of food. The undigested part of the food taken in, collects in the centre of the coelenteron and is ejected out by convulsive contractions through the wide open mouth. It is possible that the mysids make use of the ejected particles and also get protection from the coral polyps just as in the case of *H. actineae*. By removing these particles the mysids assist the corals to remain clean. Accumulation of dirt has been known to cause the death of certain types of corals (Hyman 1940). This is also likely to be a case of true commensalism but direct observation is necessary for a definite conclusion.

An intriguing feature of the association between species of *Heteromysis* and other invertebrates is that in every case, except that of hermit crabs, the mysids were found in the company of caridean shrimps. Clarke found *Alpheus armatus* Rathbun, regularly associated with *H. actineae*. Bruce (*vide* O. S. Tattersall 1962) observed *H. gymnura* with *Periclimenes lanipes* Kemp and a wide variety of shrimps were associated with *H. zeylanica*. In the present case there were a large number of small pontoniid shrimps and alpheids. Clarke found no competition between the shrimps and the mysids. That the shrimps and mysids were always found together, irrespective of the kind of the host, is interesting. Identical ecological necessities might have brought them together initially. This must have later on developed into passive toleration or active cooperation. That a dangerous animal like the sea-anemone tolerates both is significant. Obviously the association is old and well established. This is thus a fertile field for detailed investigation.

## Heteromysis S. I. Smith

*Heteromysis* W. M. Tattersall, 1922, p. 495 ; Clarke, 1955, p. 7 ; O. S. Tattersall, 1962, p. 234.

The members of the genus *Heteromysis* can be easily distinguished by their short robust body, large eyes, oblong fully setose antennal scale and above all by the massive third thoracic endopods. The near absence of sexual dimorphism in the pleopods is also characteristic.

The four species hitherto known from Indian waters differ thus :—

1a. Peduncle of the eye with a dorsal process, proximal part of lateral border of telson with spines.......................................*zeylanica*

1b. Peduncle of the eye without process, proximal part of lateral border of telson without spines.......................................2

2a. Antennal scale longer than antennal peduncle ; cornea wider than eye stalk ; endopod of uropod without spines..................*gymnura*

2b. Antennal scale not longer than antennal peduncle ; cornea narrower than eye stalk ; endopod of uropod with spines..........................3

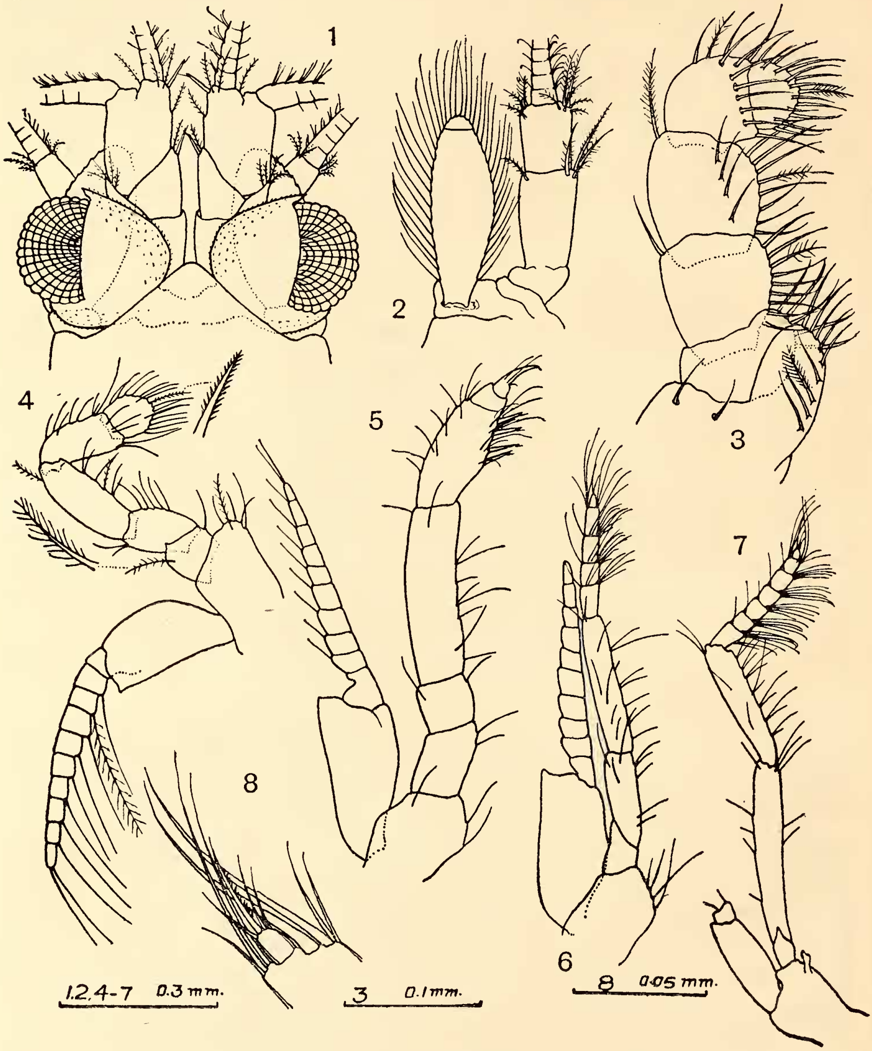
3a. Endopod of uropod armed with a single spine at the region of the statocyst ; carpopropodus of third thoracic endopod massive......*proxima*

3b. Endopod of uropod armed with 8 spines ; carpopropodus of third thoracic endopod normally developed............................*macropsis*

## **Heteromysis zeylanica** W. M. Tattersall

*Heteromysis zeylanica* W. M. Tattersall, 1922, p. 499, figs. 27a-e ; O. S. Tattersall, 1962, p. 246.

Female. Body is comparatively short with moderately stout cephalothorax and slender abdomen. Carapace has a narrow tolerably deep postero-median excavation and is anteriorly produced into a prominent triangular apically rounded rostrum (fig. 1) which reaches the middle of the basal segment of the antennular peduncle. Eyes are large with the cornea narrower than the peduncle. Below the cornea there is a small cluster of oscelli embedded inside the peduncle. The peduncle is spiny and dorso-distally produced into a sharp prominent spine-like process overlapping the cornea (fig. 1). The telson (fig. 9) is elongate-triangular, about one and a quarter times as long as broad, with a deep posterior sinus which is a third of the total length of the telson. The lateral borders of the telson are armed with fourteen pairs of spines, the first five pairs are nearly of the same size and are separated from the distal group of spines by a gap. The distal group of eight pairs of spines gradually increase in length towards the apex; the apex of each telsonic lobe is armed with two spines which are rather blunt; the outer apical spine is nearly one and a half times the length of the inner; the distance between the ultimate lateral spine and the outer apical spine is greater than the distance between any two of the lateral spines (fig. 9). The apical sinus of the telson is proximally armed with thirteen small spines, six pairs and a median spine.

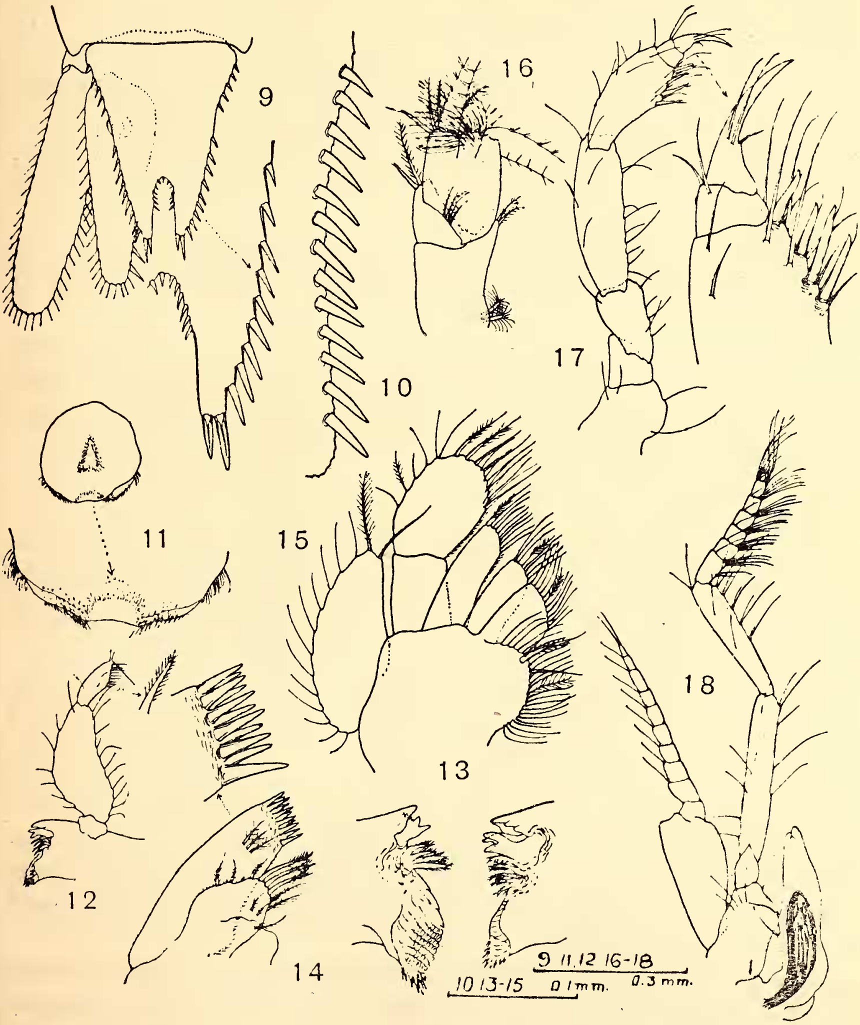



Text-Figs. 1-8. *Heteromysis zeylanica*. Female

1. Anterior part of body, dorsal view ; 2. Antenna ; 3. First thoracic endopod ; 4. Second thoracic leg ; 5. Third thoracic leg ; 6. Fourth thoracic leg ; 7. Eighth thoracic endopod ; 8. Same, tip enlarged.

The outer distal part of the first segment of the antennule is produced and carries three to four setae; second segment has a very oblique distal border and its inner distal part carries a triggered spine and a seta; inner border of the third segment has a median seta and a distal group of two setae and a triggered spine. The antennal scale (fig. 2) is rather narrow and elongate-oblong, reaching slightly short of the tip of the antennal peduncle, it is setose all round and there is a distinct apical partition.

The upper lip (fig. 11) is irregularly circular and not anteriorly produced, its distal border is spiny. The mandibles (figs. 12-13) are asymmetrical and the palps are short but stout. Outer lobe of first maxilla (fig. 14) has three inner distal setae and about eleven strong distal spines in two rows. Inner lobe is small and ovate. Second maxilla (fig. 13) is of the usual pattern with the distal segment of endopod rather large.




Text-Figs. 9-18. *Heteromysis zeylanica*. 9-15. Female. 16-18. Male.

9. Telson and uropod ; 10. Inner border of endopod of uropod ; 11. Upper lip ; 12. Mandible ; 13. Same, cutting edge enlarged ; 14. First maxilla ; 15. Second maxilla ; 16. Antennule ; 17. Third thoracic endopod ; 18. Eighth thoracic leg.

First thoracic endopod is somewhat flattened and heavily armed with strong stiff setae (fig. 3); basal segment is produced into a large inner lobe; second segment has a small lobe; there is no distinct nail. Second thoracic endopod (fig. 4) is rather slender; basal segment is slightly produced at the inner distal part; sixth segment is rounded; there is no distinct nail. Third thoracic endopod (fig. 5) is only moderately stout; carpopropodus is shorter than the merus and the distal half of its inner border is armed with four triggered spines and a few setae; there is an indistinct partition near the distal end; dactylus is small and carries a slightly curved nail with three setae near its base. Carpopropodus of thoracic endopods four to eight is subdivided into several segments; fourth (fig. 6) has four subsegments and the others (fig. 7) six subsegments; the dactylus is very small and carries a styliform nail; the last carpopropodal segment carries very long characteristically curved setae (fig. 8). Thoracic legs seven and eight carry a pair of broad lamellae; the brood pouch generally carries four embryos.

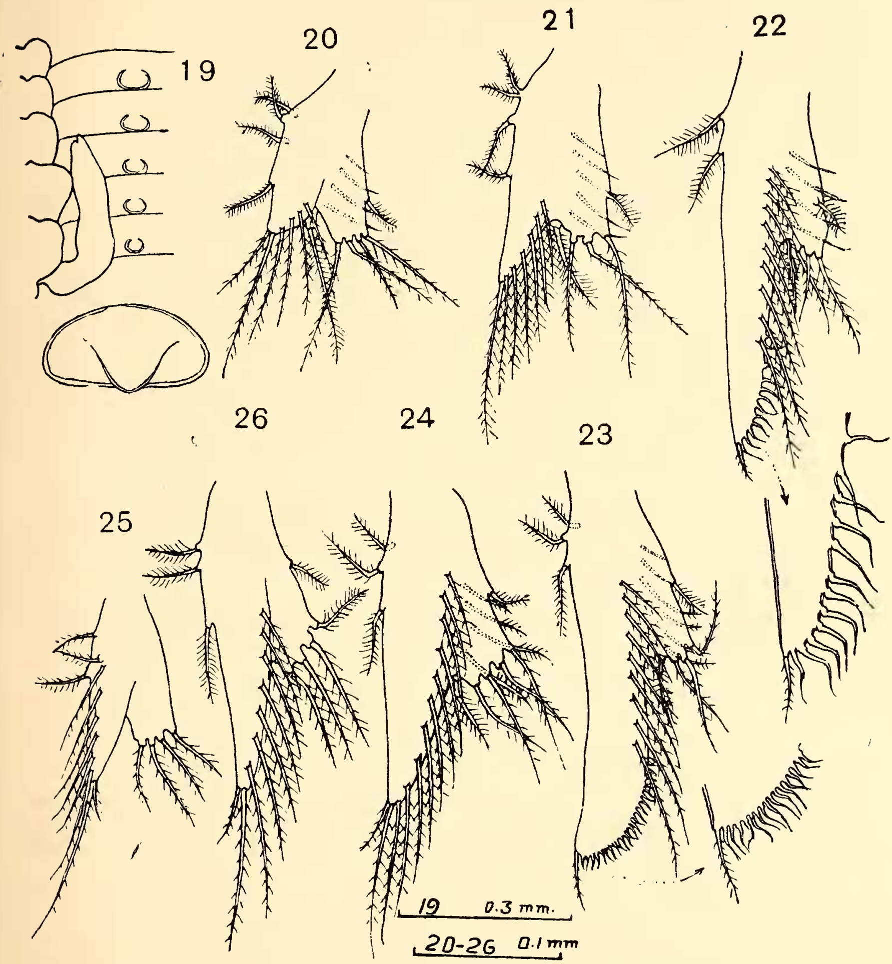
Pleopods are simple flattened plates, first pleopod is very small and distally faintly bilobed, the remaining pleopods successively increase in length.

The rami of the uropods are setose all round; exopod is longer than the endopod; both rami over-reach the telson. Beginning at the region of the statocyst and extending up to the tip is a row of twelve moderately sharp spines on the inner border of the endopod, which regularly increase in length distally (fig. 10).

Length 5 mm.

M a l e. As usual in the genus the male is very much similar to the female in general appearance. However, the following characters serve to distinguish it. The rostral prolongation of the carapace is a trifle narrower and apically more acute than in the female. The third segment of the antennular peduncle (fig. 16) carries distally on the ventral side a small lobe carrying long stiff hairs. Third thoracic endopod (fig. 17) has its carpopropodus comparatively shorter but stouter than in the female and the spines arming the inner border are stronger. The nail is more strongly curved. The eighth thoracic endopod (fig. 18) carries a large appendix masculina which is apically trilobed. Thoracic segments four to eight carry transversely oblong sternal processes becoming successively smaller backwards, each process has in the middle a small spiny prominence (fig. 19).

It is generally assumed that the pleopods are similar in the two sexes, but Coifmann (1936) described some modification of the setae in *H. digitata* and *H. harpax*. Ii (1964) found the same to be the case in *H. xanthops* but did not describe or illustrate it. In *H. zeylanica* the modification is very pronounced and easily distinguishes the males from the females. The third male pleopod (fig. 22) is comparatively longer than in the female. Its proximal half carries normal setae but the distal half has along its outer border about twelve short modified non plumose setae. Each modified seta has its distal part considerably thinned out




Text-Figs. 19-26. *Heteromysis zeylanica*. 19-24. Male. 25-26. Female.

19. Thoracic sterna five to eight showing sternal processes ; 20-24. Pleopods one to five ; 25. Pleopod two ; 26. Pleopod five.

so that the setae appear like spines when examined under low magnification. The fourth pleopod (fig. 23) is still more modified. It is rather broad throughout (not conical as in the female) and near the tip is bent inwards, the modified setae arming the border are placed so close that the appendage appears to have a closely serrate border.

Length 4·8 mm.

Remarks. The original description of this species was based on two males and two immature specimens collected at Kilakarai, Gulf of Mannar, south India. They were collected from rock pools using a hand net. Subsequently O. S. Tattersall supplemented the short original description with some notes based on twenty specimens collected from a sponge at Zanzibar. The present study shows that this species is somewhat variable in its characters.

O. S. Tattersall observed sternal processes on the last three thoracic segments of immature females but none in the male. In my specimens adult males have these processes on the last five segments but none were observed in the female. In the type the endopod of the uropod has eleven spines but O. S. Tattersall mentions only seven to eight, my specimens have up to twelve in female and thirteen in male. The basal part of the telson is armed with five spines in the female and four in the male, O. S. Tattersall noticed up to six. According to W. M. Tattersall the distal part of the lateral border is armed with eight to nine spines arranged at regular intervals, the gap between the last spine and the outer apical spine being not greater than that between any other two lateral spines. This is not so in my specimens.

W. M. Tattersall mentioned four carpopropodal segments in the thoracic endopods and O. S. Tattersall did not make any mention about this. In my specimens the fourth endopod has four subsegments and the others six subsegments.

The prominent sexual dimorphism of the pleopods has not been observed before in this species.

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